Identifier: **SOP-01.07**	Revision: **2**
Effective Date: **06/21/2004**	
Document Catalog Number: **ER2004-0336**	
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Risk Reduction and Environmental Stewardship—Environmental Restoration and Characterization

Standard Operating Procedure

for

Operational Guidelines for Taking Soil and Water Samples in Explosive Areas

Revision Log

Revision No.	Effective Date	Prepared By	Description of Changes	Affected Pages
R0	03/21/95	Betty W. Harris	New Procedure	All
R1	12/13/01	Donald Hickmott	Multiple text changes, format change to new template.	All
R2	06/21/2004	Donald Hickmott	Editorial changes and new template.	All

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Table of Contents

1.0 PURPOSE 4
2.0 SCOPE 4
3.0 TRAINING 4
4.0 DEFINITIONS 5
5.0 RESPONSIBLE PERSONNEL 7
6.0 BACKGROUND AND PRECAUTIONS 7
7.0 EQUIPMENT 10
8.0 PROCEDURE 10
8.1 Conduct Pre-sampling Activities 10
8.2 Perform Initial Contamination Characterization 11
8.3 Collect Samples 12
8.4 Transport Samples 12
9.0 LESSONS LEARNED 13
10.0 RECORDS 13
11.0 REFERENCES 14
12.0 ATTACHMENTS 14

List of Acronyms and Abbreviations

DOT	US Department of Transportation
ECR	Environmental Characterization and Remediation
HE	high explosives
IWD	integrated work document
LANL	Los Alamos National Laboratory
LIR	Laboratory Implementation Requirement
PPE	personal protective equipment
QII	Quality Integration and Improvement
QP	quality procedure
QPPL	quality program project leader
RCT	radiation control technician
RRES	Risk Reduction And Environmental Stewardship
RS	Remediation Services
SOP	standard operating procedure
SSHASP	site-specific health and safety plan
SUP	supply chain management
TA	Technical Area

Operational Guidelines for Taking Soil and Water Samples in Explosive Areas

1.0 PURPOSE

This standard operating procedure (SOP) states the responsibilities and describes the processes for taking surface and subsurface soil samples and water samples in the high explosives (HE) corridor for the Los Alamos National Laboratory (LANL) Risk Reduction and Environmental Stewardship (RRES) Division Environmental Characterization and Remediation (ECR) Group.

2.0 SCOPE

All **RRES-ECR participants** shall implement this mandatory procedure when taking surface and subsurface soil samples and water samples for RRES-ECR in the Laboratory's HE corridor.

3.0 TRAINING

3.1 **RRES-ECR participants** shall train (e.g., by reading and/or by classroom instruction) to and use the current version of this SOP; contact the author if the SOP text is unclear.

3.2 **RRES-ECR participants** using this SOP shall document training in accordance with Quality Procedure 2.2 (QP-2.2).

3.3 The responsible **project leader** shall monitor the proper implementation of this procedure and ensure that the appropriate personnel complete all applicable training assignments.

3.4 **RRES-ECR participants** may request any needed assistance with implementation of this procedure from the RRES-ECR Quality Integration and Improvement (QII) team.

3.5 Personnel entering the Laboratory's HE corridor to perform field operations shall read the site-specific health and safety plan (SSHASP), perform work under an approved integrated work document (IWD), complete the HE Corridor Access Safety Course, and complete site-specific training provided by the host group. Enhanced off-road training may be required if work is conducted off pavement within the HE corridor.

3.6 All personnel using the HE spot test kit shall complete the DX-2 training course on the use of the kit. (DX-2 is the High Explosives Group at the Laboratory).

4.0 DEFINITIONS

4.1 **Explosives** — Energetic materials possessing a tremendous amount of potential energy that can be released instantaneously when acted upon by a stimulus. This can be a violent, lethal reaction. At the Laboratory, Laboratory Implementation Requirement (LIR) 402-550-01.0, “Explosives,” governs operations with explosives.

4.2 **Field team leader** — A field team leader is responsible for ensuring that all personnel taking samples in the HE corridor have been trained and that the host group with jurisdiction over the location of the sample collection has been informed of field operations. A field team leader works directly with a project leader to plan and execute fieldwork and to coordinate and supervise specific field operations.

4.3 **HE corridor —** An area comprising TAs 6, 7, 8, 9, 11, 14, 15, 16, 22, 28, 36, 39, 40, 60, 67, 69, and 37 and associated with active and/or historical explosives development, processing, and testing operations. Extreme caution is required for all field operations in areas of active and/or historical explosives operations within the HE corridor.

4.4 **Hazard circles** — Areas in which hazards resulting from the firing of explosives or other explosive operations are likely to be present, also called *hazard zones*.

4.5 **HE representative** — A site representative, assigned by the host group or the facility manager, who has oversight or assistance responsibilities for a RRES-ECR field team.

4.6 **HE spot test kit** — A collection of chemical tests developed by DX-2 to detect explosives on surfaces. The nominal detection limit for the HE spot test kit is 100 ppm total HE. Use of the HE spot test kit is approved only for homogeneous-type samples and cannot be used reliably for heterogeneous samples.

4.7 **Heterogeneous soil sample area** — A heterogeneous soil sample area is one that contains randomly dispersed pieces of explosives that are not well mixed in a sample volume and that cannot be detected reliably using the HE spot test kit. The explosive pieces may be in large chunks or in small pieces; they may be on the surface or buried. These areas are potentially more hazardous than homogeneous areas. Examples of heterogeneous areas are the land surrounding the Technical Area 11 (TA-11) drop tower, the TA-14 firing sites, and the TA-67 (formerly TA-12) open firing pit. Determining whether a sampling area is heterogeneous or homogeneous is done by the host group. Samples that either test positive with the HE spot test kit or are collected from within a heterogeneous area must be submitted to DX-2 or to another host-group, HE-certified

laboratory, including approved field laboratories, before being handled or treated further.

4.8 **Homogeneous soil sample area** — A homogeneous soil sample area is one that contains high-solubility explosive materials that are well dispersed within the desired sample volume such that the explosives can be detected reliably by the HE spot test kit. All homogeneous samples for which HE spot test results are positive must be further analyzed by DX-2 or by another host-group, HE-certified laboratory, including field laboratories. Transport of the samples to DX-2 or to another laboratory approved by the host group must be done as specified in the work plan or SSHASP. If quantitative HE analysis determines that the total explosive content of a homogeneous sample is >5%, the sample must be handled and transported as an explosive. If the quantitative analysis determines that the total explosive content is <5%, the sample can be shipped as a nonexplosive environmental sample.

4.9 **Host group** — The operating group for the technical area in which explosives-bearing samples will be collected. At the time of this writing, DX groups are the host groups for TAs 6, 7, 8, 9, 14, 15, 22, 36, 39, 40, 60, 67, and 69, and Engineering Sciences and Applications groups are the host groups for TAs 11, 16, 28, and 37.

4.10 **Off-site** — Locations outside the control of the host group and possibly outside the HE corridor. Off-site transport usually involves the use of public roads.

4.11 **Project leader** — An University of California/staff augmentation employee or deployed worker directly responsible for the management of one or more projects for RRES-ECR. The project leader reports directly to a team leader.

4.12 **Radiation control technician (RCT)** — A person trained in radiation theory and in the use of radiation detection equipment.

4.13 **RRES-ECR participant** — An all-inclusive term for any University of California/staff augmentation employee, deployed worker, or subcontractor, inclusive of project leaders, team leaders, and project personnel, who participates in activities conducted as part of or on behalf of RRES-ECR.

4.14 **Site-specific health and safety plan (SSHASP)** — A health and safety plan that is specific to a site or RRES-ECR-related field activity and has been approved by an RRES-ECR health and safety representative. A SSHASP contains information specific to the project, including scope of work, relevant history, descriptions of hazards (by activity) associated with

the project site, and techniques for exposure mitigation (e.g., personal protective equipment [PPE]) and hazard mitigation.

5.0 RESPONSIBLE PERSONNEL

The following personnel are responsible for activities identified in this procedure:

- field team leader
- HE representative
- project leader
- QPPL
- RRES-ECR participants

6.0 BACKGROUND AND PRECAUTIONS

6.1 **RRES-ECR participants** shall use this SOP in conjunction with an approved SSHASP.

6.2 Background

6.2.1 Since the mid-1940s, the Laboratory has performed explosives development, processing, and testing operations at several TAs at the Laboratory. Because of the inherently hazardous behavior of explosive compounds, much more stringent safety requirements apply to explosives handling and operations than to most other chemical process operations. During the many years of explosives development, explosives and devices containing explosives may have been scattered or deposited both inside and outside of the hazard circles. Also, during the mid-1940s, depleted uranium, other radionuclides, and energetic materials were used in the research, development, and testing of weapon's components in the HE corridor. Therefore, extreme caution is required for all field operations in the areas where there are or were explosives operations.

6.2.2 Exposure to explosives is unknown for some locations within the HE corridor; however, contamination remains a remote possibility in these locations.

6.2.3 Some locations have a high probability of HE contamination, whether homogeneous or heterogeneous in nature. These locations include firing mounds, streambeds, and/or drainages from sites with known contamination, and outfalls from HE-processing facilities.

6.2.4 Some areas of the HE corridor may contain radionuclides, and it is possible that both HE and radiation contaminate the soil.

6.3 Facility Management

6.3.1 Before work commences, the **field team leader** ensures that all plans, including sampling, drilling, waste-management, IWDs, and SSHASPs are in place; all permits obtained; all access requirements arranged; and all training requirements identified and met.

6.3.2 The **field team leader** contacts the appropriate host groups for a review of all the proposed work and to complete the application for a facility-work request per LIR 230-03-01.5, "Facility Management Work Control."

6.4 Hazards

6.4.1 High-energy explosives and components containing high-energy explosives can be found in many colors and forms in which their presence may not be obvious. The following are some hazards associated with sampling in high-energy explosives areas:

- striking high-level HE soil with metal objects or other hard surface items
- screwing crystals of explosives between the lid and the lip of sample glass bottle
- handling pieces and chunks of weathered explosives
- detonating HE components or pieces
- initiating explosives by impact, pinch point, heat, sparks, or flames

6.4.2 Any amount of explosive in a soil sample can represent a safety hazard. Weathered explosives and explosives exposed to other substances are potentially sensitive. Strict guidelines have been established for taking and handling samples potentially contaminated with HE; for collection and removal of items, devices, or components of weapons assembly; and for transporting hazardous samples. Take the following precautions.

6.5 Precautions

6.5.1 The **field team leader** shall ensure that required SOPs, policies, and safety devices (e.g., shields, machine guards, remote setup, and PPE) are in place before sampling at locations with low-to-negligible HE contamination, HE contamination, or HE and radioactive contamination.

6.5.2 The **field team leader** shall ensure that a health physics monitor and RCT or radiological screening personnel are present for sampling at areas with HE and radioactive contamination.

6.5.3 The **field team leader** shall ensure that an authorized HE representative from the host group is on call during sample collection.

6.5.4 The **field team leader** shall ensure that the HE representative visually inspects and the RCT or radiological screening personnel scan any chunks of explosives components, materials, or objects found during sampling before the materials are transferred from the field.

6.5.5 The **field team leader** shall ensure that RRES-ECR participants do not collect samples from pure explosives or explosive components.

6.5.6 The **field team leader** shall call the assigned HE representative to arrange for host-group personnel to collect, package, label, and transport samples from pure explosives or explosive components.

6.5.7 The **field team leader** shall ensure that the removal of any material from the site is authorized by the host unit and conducted in accordance with host unit, Supply Chain Management Division Packaging and Transportation Group (SUP-5), and US Department of Transportation (DOT) requirements.

Note: Unauthorized removal of any material from the sites is not allowed.

6.5.8 The **field team leader** shall ensure that RRES-ECR participants do not handle or treat samples that field test positive for HE or samples collected from within a heterogeneous area.

6.5.9 The **field team leader** shall ensure that HE-contaminated samples and samples collected from within a heterogeneous area are submitted to DX-2 or to another host group, HE-certified laboratory, including approved field laboratories, in accordance with the transportation and handling specifications of the work plan or SSHASP.

6.5.10 The **field team leader** shall ensure that dosimeter badges are worn by personnel in areas suspected of being contaminated with radiation.

6.5.11 The **field team leader** shall ensure that an RCT or health physics monitor scans all personnel, equipment, vehicles, and supplies before they leave an area known to be contaminated with

radiation. Further requirements for work in areas of potential radiation exposure are outlined in the SSHASP.

7.0 EQUIPMENT

The equipment required for this procedure is that which is specified in the site-specific investigation work plan (sampling plan) and in the SOPs guiding sample collection.

7.1 The **field team leader** shall ensure that whenever possible the tools used to collect samples are aluminum, plastic, or other host-group–approved material that will not produce a spark when struck against rocks, concrete, or metallic objects.

Note: The host group may choose to authorize tools not covered by their SOPs to facilitate this work.

7.2 The **field team leader** shall ensure that containers used to store HE-contaminated samples shall be made of glass or nonleachable plastic with a Teflon-coated plastic lid or host-group–approved alternative.

7.3 If the sampling event or analyses require the use of utility trailers, portable laboratories, and/or any other equipment or device that may be a source of heat or produce open flames or sparks, the **field team leader** shall obtain a special permit for the equipment or devices from the host group.

7.4 The **field team leader** shall coordinate equipment reviews with the host group and ensure that appropriate special work permits are obtained before beginning the sampling event.

7.5 The **field team leader** shall ensure the review of equipment and methods required for subsurface sampling on an individual basis in the same manner that excavation and trenching work by contractors in the HE corridor is reviewed.

8.0 PROCEDURE

The following actions steps must be followed to collect, analyze, and approve off-site release of collected samples:

8.1 Conduct Pre-sampling Activities

8.1.1 The **project leader** shall ensure that either the sampling plan or a summary of the sampling plan is made available to the facility manager and that the plan or summary made available specifies the sample locations, types of sampling (surface, subsurface, or water), depth of sampling (if sampling is subsurface), quantity of samples, and analytes.

8.1.2 If subsurface sampling is requested, the **project leader** shall ensure that the sampling plan or summary made available to the facility manager provides a detailed description of the method and type of equipment that will be used to extract the samples.

8.1.3 The **field team leader** shall have responsibility for interacting with the authorized host-group personnel upon approval of the sampling plan.

8.2 Perform Initial Contamination Characterization

8.2.1 The **field team leader** shall obtain from authorized host-group personnel an identification of homogenous and heterogeneous soil sample areas within the sampling site (see Section 4 for definitions).

8.2.2 The **field team leader** shall ensure that an authorized HE representative from the host group is present during the pre-assessment.

8.2.3 The **HE representative** shall visually examine and employ a host-group–approved field analytical method (e.g., HE spot test kit, D TECH, EnSys) to perform field analysis of contamination in homogenous soil mixtures at the sampling site.

8.2.4 The **HE representative** shall use the results of the visual examination, HE spot test, or other field test to characterize the level of HE contamination as follows:

- no contamination (explosives-free): Field test results are negative and corroborated by visual examination.
- HE contaminated: Visual examination shows HE material and/or one or more of the field or HE spot tests are positive.

Note: Visual examination, HE spot testing, and other field testing methods still leave a margin of error when attempting to detect HE in soil.

8.2.5 For samples that spot-test positive for HE or that are collected from heterogeneous areas, the **HE representative** shall

1. arrange packaging, labeling, and transportation of the sample to DX-2 or a host-group–approved laboratory for analysis, or
2. contact SUP-5 at 665-8628 for help with off-site shipping.

8.2.6 Using the field results and the quantitative analytical results for samples submitted to DX-2, the **field team leader** shall categorize areas within the sampling site by their potential for contamination as follows:

- no HE contamination (explosives-free areas)
- low-to-negligible HE contamination
- HE contamination
- HE and radioactive contamination

8.3 Collect Samples

8.3.1 To conduct drilling operations in the HE corridor, **RRES-ECR participants** shall follow SOP-4.01, "Drilling Methods and Drill Site Management," and SOP-4.04, "Contract Geophysical Logging."

8.3.2 To sample surface water, **RRES-ECR participants** shall follow SOP-6.13, "Surface Water Sampling."

8.3.3 To collect soil samples, **RRES-ECR participants** shall follow SOP-6.09, "Spade-and-Scoop Method for the Collection of Soil Samples."

Note: Remote drilling may be required at locations where significant amounts of subsurface contamination are possible.

8.4 Transport Samples

8.4.1 The **field team leader** shall obtain written approval from authorized host-group or division personnel for the removal from the HE corridor of homogeneous samples containing >5% HE and heterogeneous samples collected from pure explosives or explosive components.

8.4.2 The **field team leader** shall call the HE representative to arrange for packaging, labeling, and transportation of homogeneous samples in which the total explosive content is >5% and heterogeneous samples collected from pure explosives or explosive components.

8.4.3 For homogeneous samples in which the total explosive content of the sample is >5% and for heterogeneous samples collected from pure explosives or explosive components, The **HE representative** shall

1. arrange packaging, labeling, and transportation of the sample to DX-2 or a host-group–approved laboratory, or
2. contact the SUP-5 at 665-8628for help with off-site shipping.

Note: The field team leader and the HE representative must be sure to follow existing Laboratory guidelines and any additional hazardous material shipment requirements specified for the

specific location or by the host group for labeling, packaging, and transporting HE samples. Off-site transportation of HE samples must follow DOT regulations.

8.4.4 If the quantitative analysis determines that the total explosive content of a sample is <5%, the **field team leader** shall determine whether the sample can be shipped as a nonexplosive environmental sample.

Note: Transport samples taken from explosives-free areas as nonhazardous materials only if no other hazardous substances are present.

8.4.5 Under the direction of the field team leader, **RRES-ECR participants** shall appropriately package and label samples taken from explosives-free areas.

9.0 LESSONS LEARNED

9.1 Before performing work described in this SOP, **RRES-ECR participants** should go to the Department of Energy Lessons Learned Information Services home page, located at http://www.tis.eh.doe.gov/ll/ll.html, and/or to the LANL Lessons Learned Resources web page, located at http://www.lanl.gov/projects/lessons_learned/, and search for applicable lessons.

9.2 During work performance and/or after the completion of work activities, **RRES-ECR participants**, as appropriate, shall identify, document, and submit lessons learned in accordance with the LANL, Lessons Learned System located at http://www.lanl.gov/projects/lessons_learned/.

10.0 RECORDS

The **field team leader** is responsible for submitting the following records (processed in accordance with QP-4.4, "Record Transmittal to the Records Processing Facility") to the Records Processing Facility:

- Chain-of-Custody Forms/Request-for-Analysis Forms
- field notebooks or daily activity logs
- sample collection logs
- completed Document Signature Forms
- all associated correspondence

11.0 REFERENCES

Maps of the TAs within the HE corridor (TAs 6, 7, 8, 9, 11, 14, 15, 16, 22, 28, 36, 39, 40, 60, 67, 69, and 37) are available at https://int.lanl.gov/tools/maps/maps.shtml.

To implement this SOP properly, **RRES-ECR participants** should become familiar with the contents of LIR 230-03-01.5, "Facility Management Work Control" and LIR 402-550-01.0, "Explosives," located at http://int.lanl.gov/policies/manual/excellence.shtml and with the contents of the following documents located at http://erinternal.lanl.gov/home_links/Library_proc.shtml:

- QP-2.2, "Personnel Training Management"
- QP-4.4, "Record Transmittal to the Records Processing Facility"
- QP-4.9, "Document Development and Approval Process, Peer Review Required"
- QP-5.7, "Notebook Documentation for Environmental Restoration Technical Activities"
- RRES-RS "Quality Management Plan"
- SOP-01.01, "General Instructions for Field Investigations"
- SOP-01.04, "Sample Control and Field Documentation"
- SOP-01.06, Management of Environmental Restoration Project Waste"
- SOP-01.08, "Field Decontamination of Drilling and Sampling Equipment"
- SOP-04.01, "Drilling Methods and Drill Site Management"
- SOP-04.04, "Contract Geophysical Logging"
- SOP-06.09, "Spade-and-Scoop Method for the Collection of Soil Samples"
- SOP-06.13, "Surface Water Sampling"

12.0 ATTACHMENTS

None

Using a token card, click here to record "self-study" training to this procedure.

If you do not possess a token card or encounter problems, contact the RRES-ECR training specialist.